IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Assignee ..... Micron Technology, Inc.
Group Art Unit 1765
Examiner ..... Deo, Duy Vu Nguyen
Attorney's Docket No. MI22-1376
Title: Methods of Removing at Least Some of a Material from a Semiconductor Substrate

BRIEF OF APPELLANT

To: MS Appeal Brief - Patents
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Appellant appeals from the April 02, 2003 Office Action rejecting claims 1-6 and 12-35. This brief is submitted in triplicate. A check is included in the amount of $320.00 in payment of the fees required under 37 CFR 1.17(c).

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST.....3

II. RELATED APPEALS AND INTERFERENCES.....3

III. STATUS OF THE CLAIMS.....3

IV. STATUS OF AMENDMENTS.....3

V. SUMMARY OF THE INVENTION.....4

VI. ISSUES.....5

VII. GROUPING OF CLAIMS.....5

VIII. ARGUMENT.....6

A: Claims 1-6 and 12-35 are fully supported by the specification within the meaning of 35 U.S.C § 112, first paragraph......6

1. Summary of the Office's rejection......6

2. The § 112, first paragraph rejection of claims 1-6 and 12-35 should be reversed because the claims are fully supported by the specification.....6

B: Claims 1-6 and 12-35 particularly point out and distinctly claim the subject matter which the applicant regards as the invention......8

1. Summary of the Office's rejection......8

2. The § 112, second paragraph rejection of claims 1-6 and 12-35 should be reversed because the claims are definite..... 9

IX. CONCLUSION.....10

X. APPENDIX.....11

I. REAL PARTY IN INTEREST.

The real party in interest of this application is Micron Technology, Inc. as evidenced by the assignment of the pending application to such party recorded at reel 012040, frame 0203-0206 on August 02, 2001, in the Assignment Branch of the Patent and Trademark Office.

II. RELATED APPEALS AND INTERFERENCES.

Appellant, Appellant's undersigned legal representative and the assignee of the pending application are not aware of any appeals or interferences pending at the time of filing the present appeal that will directly affect, be directly affected by, or have a bearing on the Board's decision in the present appeal

III. STATUS OF THE CLAIMS.

Claims 1-6 and 12-35 are pending in the application with claims 7-11 being previously canceled from the application. Claims 1-6 and 12-35 stand finally rejected and are the basis for the present appeal.

IV. STATUS OF AMENDMENTS.

No amendments have been filed in the application subsequent to final rejection.

V. SUMMARY OF THE INVENTION.

A concise explanation of the invention defined in the claims that are the subject of the present appeal follows.

The invention pertains to methods of removing at least some of a material from a semiconductor substrate. Referring to Fig. 1 of Appellant's specification, the method includes feeding a feed gas 24 comprising at least 99.999% O_2 by volume into an ozone generator 18 (col. 4, ll. 14-17). Ozone 20 is generated from the feed gas (page 4, lines 17-18) and ozone or reactive fragments thereof are used to contact and react with a material 19 on a semiconductor substrate 16 (page 6, lines 3-19). The contacting of the ozone or fragment of the ozone, with material 19 allows removal of at least some of material 19 from substrate 16.

Exemplary materials for material 19 include various photoresist materials or other organic materials (page 6, lines 3-7). Material 19 can be over a layer 17 which can comprise aluminum oxide, platinum or other materials associated with fabrication of integrated circuitry (page 5, line 22 through page 6, line 2).

As discussed in the background section of appellant's specification, prior art methodology includes methods utilizing lower oxygen purity and/or nitrogen spiked feed gases (page 2, lines 1-10). In contrast, as set forth in appellant's specification at page 4, line 14 through page 5, line 10, utilization of high purity oxygen feed gas in accordance with the invention allows the concentration of nitrogen within the feed gas to be reduced. This in turn minimizes nitrous oxides which can be corrosive and otherwise damaging to integrated circuitry exposed to the nitrous oxides. Additionally, nitrous oxides can be corrosive to materials such aluminum oxide. Accordingly, the ozone generating feed gas

24 of the invention preferably comprises at least 99.999% O_2 and less than or equal to 0.001% N_2 (by volume).

VI. ISSUES.

The issues presented for review are concisely stated as follows.

Issue 1: Do claims 1-6 and 12-35 recite subject matter which is not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed, and therefore fail to comply with the requirements of 35 U.S.C. § 112, first paragraph?

Issue 2: Do claims 1-6 and 12-35 fail to particularly point out and distinctly claim the subject matter which the applicant regards as the invention so as to be indefinite under 35 U.S.C. § 112, second paragraph?

VII. GROUPING OF CLAIMS.

Claims 1-6 and 12-35 stand or fall as a group.

VIII. ARGUMENT.

A: Claims 1-6 and 12-35 are fully supported by the specification within the meaning of 35 U.S.C § 112, first paragraph.

1. Summary of the Office's rejection.

The Office indicates at page 2 of the April 2, 2003 Action that independent claims 1, 12 and 25 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors had possession of the claimed invention at the time the application was filed. The Office indicates that the limitation "in an absence of additionally added gases" recited in each of the three independent claims is not supported by the specification. Although the basis of the rejection of the dependent claims is not specified in the Action, appellant assumes that such rejection is based upon being dependent upon a corresponding rejected base claim. Appellant's arguments are set forth accordingly.

2. The § 112, first paragraph rejection of claims 1-6 and 12-35 should be reversed because the claims are fully supported by the specification.

As set forth in MPEP § 2163.02, determining compliance with the written description requirement of § 112 is to be based upon what is reasonably conveyed by the specification to one skilled in the art. Added or amended claims must "reasonably convey to the artisan that the inventor had possession at that time [the time of filing the application] of the later claimed subject matter" (citing *Ralston Purina Co. v. Far-Mar-Co., Inc.,* 772 F.2d 1570,

1575, 227 USPQ 177, 179 (Fed. Cir. 1985)). With respect to a claim element which is added by amendment, a rejection of such claim under the written description requirement of § 112 is proper only when the amendment involves "a departure from, addition to or deletion from the disclosure of the application as filed". The terminology utilized in the claims need not be identical to the terms utilized in the specification to satisfy the description requirement. A lack of literal basis in the specification for a negative limitation may not be sufficient to establish a *prima facie* case for lack of descriptive support (MPEP § 2173.05(i), quoting *Ex parte Parks,* 30 USPQ2d 1234, 1236 (Bd. Pat. App. & Inter. 1993)). The burden of establishing a lack of adequate description of the invention set forth in the claims is upon the Office (MPEP § 2163.04). Thus, the Office has the burden of explaining "why persons skilled in the art would not recognize in the disclosure a description of the invention defined by the claims" (MPEP § 2163.04(II)).

As set forth above and as noted by Appellant in response to previous office actions, the specification as originally filed describes providing a feed gas to an ozone generator to form ozone (see, for example, page 4, line 14 through page 5, line 10). The description further indicates providing a feed gas purity of at least 99.999% oxygen, by volume. As explained in appellant's specification, the high purity oxygen feed gas is utilized to provide a reduced concentration of nitrogen within the feed gas to decrease or avoid detrimental effects that can occur at higher nitrogen concentrations. The specification additionally indicates with reference to Fig. 1 that a feed gas source 22 is provided and a feed gas 24 is flowed from source 22 to ozone generator 18. The description clearly describes a single feed gas 24 being provided to ozone generator 18, thus the recited "in an absence of additionally added gases" is inherent in the disclosure. A person of ordinary skill in the art, when considering Fig. 1 and the accompanying text at page 4, lines 14 through page 5, line

10, would understand that the invention encompasses embodiments as recited in independent claims 1, 12 and 25, where the feed gas comprises at least a 99.999% O_2 and is fed through the ozone generator in an absence of additionally added gases. The recited phrase "in an absence of additionally added gases" does not depart from, add to or delete from the disclosure as originally filed. Accordingly, the limitation "in an absence of additionally added gases" is fully supported by the specification as originally filed and claims 1, 12 and 25 meet the description requirements under 35 U.S.C. § 112, first paragraph.

Dependent claims 2-6, 13-24 and 26-35, which stand rejected as being dependent from a rejected base claim, are allowable for the reasons set forth above. Accordingly, the § 112, first paragraph rejection of claims 1-6 and 12-35 should be reversed.

B: Claims 1-6 and 12-35 particularly point out and distinctly claim the subject matter which the applicant regards as the invention.

1. Summary of the Office's rejection.

The Office indicates at page 2 of the Action dated April 2, 2003, that claims 1, 12 and 25 fail to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. The Office indicates that the recited limitation "in an absence of additionally added gases, feeding the feed gas through an ozone generator to generate ozone from the feed gas" is indefinite because "it was an attempt to claim the invention by excluding what the inventors did not invent rather than distinctly and particularly pointing out what they did invent".

2. The § 112, second paragraph rejection of claims 1-6 and 12-35 should be reversed because the claims are definite.

As set forth in MPEP § 2173.03, inquiry regarding the definiteness of a claim is not conducted in a vacuum but in light of the content of the application disclosure, the teaching of prior art, and the claim interpretation that would be given by one possessing an ordinary level of skill in the art. Additionally, negative limitations are not inherently ambiguous and do not render a claim indefinite if the boundaries of the patent protection sought are clear (MPEP § 2173.05(i)). As discussed above, the recited limitation "in an absence of additionally added gases" is fully supported by the specification. Applicant's specification distinctly describes providing a high purity feed gas and indicates that methods of the invention utilizing such high purity feed gas overcomes drawbacks of utilizing lower purity feed gas. When considered in light of the content of Appellant's disclosure, the recited feeding the feed gas in an absence of additionally added gases particularly points out the subject matter which the applicant regards as the invention. One of ordinary skill in the art interpreting the language of independent claims 1, 12 and 25 would be informed of the boundaries of what would constitute infringement of the claims and would be apprised of the scope of the claims in accordance with MPEP § 2171. Each of independent claims 1, 12 and 25 and their corresponding dependent claims 2-6, 13-24 and 27-35 are not rendered indefinite by the recited negative limitation "in an absence of additionally added gases" and comply with the requirements of 35 U.S.C. § 112, second paragraph. Accordingly, the § 112, second paragraph, rejection of claims 1-6 and 12-35 should be reversed.

IX. CONCLUSION.

In view of the foregoing, reversal of the final rejections of claims 1-6 and 12-35 is respectfully requested. Allowance of such claims is also requested.

Respectfully submitted,

Dated: September 30, 2003 By: Jennifer J. Taylor
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X. APPENDIX.

Claims 1-6 and 12-35 which stand finally rejected and are the basis of the present appeal are presented below.

1. A method of removing at least some of a material from a semiconductor substrate, comprising:

providing a feed gas comprising at least 99.999% O_2 (by volume);

in an absence of additionally added gases, feeding the feed gas through an ozone generator to generate ozone from the feed gas; and

contacting the ozone or a fragment of the ozone with a material on a semiconductor substrate to remove at least some of the material from the semiconductor substrate.

2. The method of claim 1 further comprising irradiating at least some of the ozone with ultraviolet light prior to the contacting.

3. The method of claim 1 further comprising irradiating at least some of the ozone with ultraviolet light proximate the material.

4. The method of claim 1 wherein the material on the semiconductor substrate is photoresist.

5. The method of claim 1 further comprising mixing the ozone with water vapor prior to the contacting.

6. The method of claim 1 further comprising mixing the ozone with an organic solvent vapor prior to the contacting.

12. A method of removing at least some of a material from a semiconductor substrate, comprising:

providing a feed gas comprising 99.999% O_2 and less than or equal to 0.001% N_2 (by volume);

in an absence of additionally added gases, feeding the feed gas through an ozone generator to generate ozone from the feed gas;

forming a mixture of ozone and organic solvent vapors in a reaction chamber; and

contacting at least some of the ozone and solvent vapors with a material on a semiconductor substrate to remove at least some of the material from the semiconductor substrate.

13. The method of claim 12 wherein the material on the semiconductor substrate is photoresist.

14. The method of claim 12 wherein the material on the semiconductor substrate is photoresist; wherein the semiconductor substrate comprises Al_2O_3; and further comprising exposing at least some of the Al_2O_3 to the ozone during the contacting.

15. The method of claim 12 wherein the material on the semiconductor substrate is photoresist; wherein the semiconductor substrate comprises platinum; and further comprising exposing at least some of the platinum to the ozone during the contacting.

16. The method of claim 12 further comprising providing a reservoir of volatile organic solvent within the reaction chamber and forming the solvent vapors from the volatile organic solvent.

17. The method of claim 16 wherein the volatile organic solvent is a liquid.

18. The method of claim 16 wherein the volatile organic solvent comprises acetone.

19. The method of claim 16 wherein the volatile organic solvent consists essentially of acetone.

20. The method of claim 16 wherein the volatile organic solvent comprises cyclohexanone.

21. The method of claim 16 wherein the volatile organic solvent consists essentially of cyclohexanone.

22. The method of claim 16 wherein the volatile organic solvent comprises a mixture of cyclohexanone and PGMEA.

23. The method of claim 16 wherein the volatile organic solvent comprises propylene glycol.

24. The method of claim 12 further comprising providing a reservoir of volatile organic solvent within the reaction chamber and heating the volatile organic solvent to form the solvent vapors from the volatile organic solvent.

25. A method of removing at least some of a material from a semiconductor substrate, comprising:

providing a feed gas comprising 99.999% O_2 and less than or equal to 0.001% N_2 (by volume);

in an absence of additionally added gases, feeding the feed gas through an ozone generator to generate ozone from the feed gas;

forming a mixture of ozone and organic solvent vapors in a reaction chamber;

irradiating at least some of the ozone with ultraviolet light to form ozone fragments from the ozone; and

contacting at least some of the ozone fragments and solvent vapors with a material on a semiconductor substrate to remove at least some of the material from the semiconductor substrate.

26. The method of claim 25 wherein the material on the semiconductor substrate is photoresist.

27. The method of claim 25 further comprising providing a reservoir of volatile organic solvent within the reaction chamber and forming the solvent vapors from the volatile organic solvent.

28. The method of claim 27 wherein the volatile organic solvent is a liquid.

29. The method of claim 27 wherein the volatile organic solvent comprises acetone.

30. The method of claim 27 wherein the volatile organic solvent comprises cyclohexanone.

31. The method of claim 27 wherein the volatile organic solvent comprises a mixture of cyclohexanone and PGMEA.

32. The method of claim 27 wherein the volatile organic solvent comprises propylene glycol.

33. The method of claim 25 further comprising providing a reservoir of volatile organic solvent within the reaction chamber and heating the volatile organic solvent to form the solvent vapors from the volatile organic solvent.

34. The method of claim 25 wherein the material on the semiconductor substrate is photoresist; wherein the semiconductor substrate comprises Al_2O_3; and further comprising exposing at least some of the Al_2O_3 to the ozone fragments during the contacting.

35. The method of claim 25 wherein the material on the semiconductor substrate is photoresist; wherein the semiconductor substrate comprises platinum; and further comprising exposing at least some of the platinum to the ozone fragments during the contacting.